

31 May 1994

TSMNP-D
TEST SET, RADIO

1. GENERAL. This procurement requires a portable radio test set for use with radio receiving and transmitting equipment.

2. CLASSIFICATION. Type II, Class 3, Style C, and Color R in accordance with MIL-T-28800 for shipboard applications.

3. FUNCTIONAL REQUIREMENTS. The equipment shall be capable of signal generation, monitoring, amplitude level and frequency measurement, power measurement, modulation analysis, and receiver signal-to-noise measurement, within the minimum specifications identified below.

3.1 RF signal generator.

3.1.1 Generator frequency range. 400 kHz to 999.99 MHz tuneable in increments of 100 Hz.

3.1.2 Generator frequency accuracy. Equal to time base accuracy (see 3.11).

3.1.3 Residual FM. 25 Hz rms.

3.1.4 Generator output power. Continuously adjustable from -127 dBm to 0 dBm. Accuracy: ± 1.5 dB.

3.1.5 Generator spectral purity. For frequencies between 100 and 500 MHz: -30 dBc for harmonics, -60 dBc for non-harmonics and -65 dBc for integrated noise within the offset band of 13 to 31 kHz.

3.1.5.1 Single sideband phase noise. -110 dBc/Hz at a 25 kHz offset.

3.1.6 Modulation. FM and AM from internal source, external source, and supplied microphone.

3.1.6.1 Frequency modulation.

3.1.6.1.1 Modulation deviation. 0 to 25 kHz peak from 400 kHz to 999.99 MHz. Accuracy (1 kHz rate and 10 kHz deviation): $\pm 8\%$.

3.1.6.1.2 Modulation frequency response. 20 Hz to 10 kHz.

3.1.6.2 Amplitude modulation.

3.1.6.2.1 AM frequency response. 100 Hz to 10 kHz from 1.5 MHz to 999.99 MHz.

3.1.6.2.2 Percentage of modulation range. 0 to 90% with modulating frequencies from 100 Hz to 10 kHz. Accuracy (1 kHz rate and 50% AM): $\pm 4\%$.

3.2 RF signal analyzer.

3.2.1 Analyzer frequency range. 400 kHz to 999.99 MHz.

3.2.2 RF analyzer input sensitivity. 5 mW or less.

3.2.3 Single Sideband Demodulator. A single sideband demodulator or other means shall be

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provided for detecting single sideband transmissions.

3.2.4 RF frequency error measurement. The analyzer shall indicate the difference in frequency of the RF signal under test and a predetermined value entered by the operator.

3.2.4.1 RF frequency error measurement accuracy. Equal to time base accuracy ± 1 Hz.

3.2.4.2 RF frequency error measurement resolution. 10 Hz or less.

3.2.4.3 RF frequency error measurement range. ± 10 kHz minimum.

3.2.5 Analyzer FM deviation range. 0 to 25 kHz peak deviation. Accuracy: $\pm 7.5\%$ of indication plus the peak residual FM at modulation frequencies of 30 Hz to 10 kHz.

3.2.5.1 FM input sensitivity. For 10 dB EIA SINAD: 5.0 μ V.

3.2.6 Analyzer AM percentage range. 0 to 90%. Accuracy: $\pm 8\%$ FS +1 LSD at modulation frequencies of 300 Hz to 10 kHz.

3.2.7 Signal strength measurement. A means shall be provided to measure the relative level of off-the-air signals received by an antenna supplied with the instrument.

a. Frequency range: 3 MHz to 999.99 MHz.

b. Level range. -100 dBm to +10 dBm.

3.3 RF wattmeter. An RF wattmeter and load shall be provided to measure the power generated by units under test at frequencies above 1.5 MHz, and to terminate a 50-ohm system with an SWR of 1.25 or less.

a. Power range. 1 mW to 60W.

b. Accuracy. $\pm 10\%$ of indication for inputs > 200 mW.

c. Load. The RF load shall be capable of terminating 100W for at least 10s per minute and 60W continuously.

3.3.1 Wattmeter over-temperature protection. Visual and audible over-temperature warnings shall be provided.

3.4 Duplex generator. A duplex generator function or other means shall be provided to test equipment transmitting and receiving simultaneously on offset frequencies.

3.4.1 Duplex frequency offset. Full offset capability shall be provided.

3.4.2 Duplex output level. -115 to -15 dBm. Resolution: 0.1 dBm.

3.4.3 Duplex generator deviation. The carrier shall be capable of being frequency modulated at deviations from 0 to 25 kHz peak.

3.4.4 Sensitivity. In duplex mode, the equipment shall operate properly with input levels of 20 mW or less.

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3.5 Oscilloscope. An oscilloscope function shall be provided to monitor the modulation characteristics of AM and FM signals.

3.5.1 Oscilloscope display size. At least five square inches.

3.5.2 Oscilloscope frequency response. DC to 50 kHz.

3.5.3 Oscilloscope vertical input ranges. 10 mV to 10 V/div.

3.5.4 Oscilloscope horizontal sweep rate. 100 us/div to 20 ms/div.

3.6 AF frequency measurement. A frequency counter function shall be provided to measure audio frequencies.

3.6.1 AF frequency measurement range. 20 Hz to 20 kHz with a resolution of 1 Hz. Accuracy: ± 2 counts.

3.7 AF signal generator. Two independently variable audio frequency signal generators shall be provided to generate the tones required by various two-tone signaling systems such as DTMF.

3.7.1 AF generator frequency range. 10 Hz to 20 kHz with a resolution of 1 Hz.

3.7.2 AF generator output level. 4 Vrms minimum into 600 ohms.

3.8 SINAD meter. A means shall be provided to measure the sensitivity of a receiver with respect to the ratio of the signal plus noise and distortion to noise and distortion.

3.8.1 SINAD meter frequency. The equipment shall provide a test signal modulated by 1 kHz to the receiver under test.

3.8.2 SINAD meter input range. 0.1 Vrms to 10 Vrms.

3.8.3 SINAD meter measurement range. 1 dB to 45 dB. Accuracy: ± 1.5 dB.

3.9 Distortion measurements.

3.9.1 Fundamental frequency. 1 kHz nominal.

3.9.2 Level range. 50 mVrms to 10 Vrms.

3.9.3 Distortion range. 0.1% to 20%.

3.9.4 Accuracy. ± 1 dB.

3.10 AF voltmeter. An AF voltmeter shall be provided for DC and AC voltage measurements.

3.10.1 AC measurements.

3.10.1.1 Frequency range. 50 Hz to 20 kHz.

3.10.1.2 Level range. 0 to 30 Vrms.

3.10.1.3 Accuracy. $\pm(3\%$ of indication + 3 mV + 1 LSD).

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3.10.2 DC measurements.

3.10.2.1 Level range. 0 to 40V.

3.10.2.2 Accuracy. $\pm(1\%$ of indication + 50 mV).

3.11 Time base accuracy. 0.1 ppm.

3.11.1 Time base aging. 0.5 ppm per year.

3.11.2 Time base temperature stability. 0 to 55°C: ± 0.05 ppm.

3.12 Loudspeaker. The equipment shall contain an internal loudspeaker.

3.13 Reference frequency input. 5 MHz.

3.14 Spectrum analyzer. The equipment shall be provided with a spectrum analyzer in accordance with the following specifications.

3.14.1 Frequency range. 400 kHz to 1 GHz.

3.14.2 Scan widths. 50 kHz to 1 MHz/div and full scan.

3.14.3 Resolution bandwidths. 300 Hz to 300 kHz.

3.14.4 Sensitivity. -95 dBm at lowest resolution bandwidth.

3.14.5 Dynamic range. 80 dB.

3.14.6 Display log scales. 2 and 10 dB per division.

3.14.7 Average noise level. -90 dBm at lowest resolution bandwidth.

3.14.8 Level accuracy. ± 3 dB.

3.14.9 Markers. Independently tuneable markers shall provide readouts of frequency and amplitude for any point and relative readings between center frequency and any other point.

3.14.10 Tracking generator. A tracking generator shall be provided that has frequency and output power equivalent to that of the signal generator (see 3.1.1 and 3.1.4).

3.15 Audio filters. 50 Hz high-pass, 300 Hz high-pass, 15 kHz low-pass, 3 kHz low-pass and 1 kHz notch.

3.16 Accessories. For audio analysis the equipment shall be provided with a 600-ohm input impedance or a 600-ohm balanced interface as an accessory.

4. GENERAL REQUIREMENTS.

4.1 Power source. MIL-T-28800 nominal and dc external power source requirements are invoked as detailed below.

4.1.1 Nominal power source. Maximum power consumption: 300W.

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4.1.2 DC external power source. 11-18 Vdc, 120W maximum. The equipment shall be provided with a DC power cord for connecting to external DC sources.

4.2 Weight. 21 kg (46 lb) maximum.

4.3 Digital interface. The equipment shall be provided with a digital interface in accordance with MIL-T-28800.

4.4 Lithium batteries. Per MIL-T-28800, lithium batteries are prohibited without prior authorization. A request for approval for the use of lithium batteries, including those encapsulated in integrated circuits, shall be submitted to the procuring activity at the time of submission of proposals. Approval shall apply only to the specific model proposed.

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